

Chairman, that the committee was  
 iful effects of smoking started with  
 ect. There was worry about the  
 ong before anybody thought of

o say, Doctor, was that most of the  
 discussion of the smoking problem  
 any other disease.

my comment on that, it has been  
 art has caught the public imagina-  
 science writers. In one of the first  
 with the sentence: "I am not talk-  
 or part of the effect, I am talking  
 larly coronary heart disease." The  
 and other media said I talked  
 cancer" and they didn't mention

unaware of this other effect than  
 a great deal of evidence on this.

curiosity, how do you get dogs to  
 bout that.

of habituate them, they ask for it.

right.

h r trachea. This is not painful to  
 one therapeutically if somebody  
 ip their trachea. They can breathe  
 eathe through here. We put a tube  
 t a cigarette on the other end.  
 ay-so about what he does.

osed by the dog. If he opens it, he  
 it he draws air from the cigarette.  
 ie urging to begin with, most of  
 it. Some are not. It is very much  
 you give them too many cigarettes  
 eated or dizzy. But once they get

oken almost entirely—

ed a bill here last year on the other  
 the dog and cat bill. I am glad to  
 Committee that this doesn't hurt

hurt them any more than it hurts  
 oluntarily.  
 of doing it.

uple of dogs who liked chewing  
 ot them to smoke. Okay.  
 as been about tar and nicotine and  
 on General and almost everybody

else has said, if we must make a guess, then it would be my guess the  
 major harmful effects are in the tar and nicotine. However, at this point  
 we cannot rule out the possibility that the most harmful effects are in  
 the gases contained in the cigarette smoke. There are quite a few gases.  
 The one that worries me most is carbon monoxide. Carbon monoxide  
 worries me not only because it is in the cigarette smoke, but it is also  
 in the city streets, also in the garages, also in tunnels. And if somebody  
 smokes and is exposed to carbon monoxide in the city streets, then he  
 gets quite a dosage of this very poisonous gas. He has two different  
 sources of it, the larger being cigarette smoke exposure, the smaller  
 being air pollution exposure. When you add the two together, this  
 gets to levels that are bordering on the acute toxic level.

Now a great deal is known about the immediate effect of inhaling  
 carbon monoxide. One of the things it does is reduce oxygen carrying  
 capacity of the blood, and another thing it does is increase the number  
 of cells in the blood, and these may quite possibly be the major factor  
 in the association between cigarette smoking and death rate from  
 coronary artery disease. I do not assert this as so. I think nicotine is  
 more likely to be. I am only urging further research to determine this.  
 Because if the carbon monoxide were the worst agent, it would be a  
 little foolish to take out the nicotine. We could do something about the  
 carbon monoxide, and nobody smokes for the carbon monoxide con-  
 tent; I believe.

Now let me finish by making just one statement. My own feeling is  
 that you can vary the cigarette in any way you please, we can study  
 all of these various agents and paint them on the skin of mice, any-  
 thing else, can change the cigarette. The big problem is to find out  
 whether having done so you have accomplished anything in reducing  
 the harmful effects. My guess is that reducing tar and nicotine does  
reduce the harmful effects, but this is a long way from getting ob-  
 jective evidence on it. I think our best bet is animal experimentation,  
 since to get human evidence is so extremely difficult.

What Dr. Auerbach with the dogs is seeking to do is find an experi-  
 mental situation in which an animal smokes in as close a way as pos-  
 sible as a man does. If you give the animal more cigarettes a day rela-  
 tive to his weight than a man can smoke, you can asphyxiate him; you  
 can asphyxiate anybody with enough carbon monoxide.

What we hope to do is find an animal where you get the same effects  
 of smoking cigarettes that people get from smoking cigarettes. If we  
 find such an animal, then we have a means of testing one cigarette  
 against another.

Now as far as these dogs that we have now, we have found that we  
 can get the early changes on the road to lung cancer. So we have a  
 way of testing one cigarette against another in relation to lung cancer  
 in the inhalation experiments with dogs. They get emphysema. We  
 can test that. They get changes in their blood produced by carbon  
 monoxide. We can test that. But they ordinarily do not get athero-  
 sclerosis of the coronary arteries, whereas practically all American  
 men whether they smoke or don't smoke get atherosclerosis of the  
 coronary arteries, probably because of the American diet. I am not in  
 that field; that is a guess.

The CHAIRMAN. What do we eat that is wrong?

Dr. HAMMOND. This is not my field, sir.

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The CHAIRMAN. I want to get some advice on it, so I can quit right now.

Dr. HAMMOND. A great many people in heart research, feel that one type of fat, cholesterol, is responsible for atherosclerosis of the coronaries. I have no strong opinion one way or the other. However, by giving dogs cholesterol and a certain drug, you can produce atherosclerosis of the coronary arteries in them very much like a man and it appears cigarette smoking probably has the effect of simply causing death in the cigarette smoker who already has atherosclerosis and probably would have died of it much later.

I am trying to express the fact that we must have an animal model where we can test all of the effects of smoking. If I am told a cigarette has no benzpyrene in it, and it is safe to smoke because this won't cause cancer. I would have awfully little interest and I would say the same thing if it was said about emphysema or heart disease. These are excessive causes of death. And we might produce a cigarette in respect of one of these things and more harmful in respect to the other.

I think before we could say a cigarette was safer we would have to test it in relation to all of these effects. Personally, I am hopeful that we will eventually be able to develop a less harmful cigarette. My guess is some of the present cigarettes are less harmful. I am not as certain whether we can ever produce a cigarette where the harmful effects are so slight we would no longer call it a public health hazard.

(The prepared statement follows:)

PREPARED STATEMENT OF DR. E. CUYLER HAMMOND, VICE PRESIDENT, EPIDEMIOLOGY AND STATISTICS, AMERICAN CANCER SOCIETY, INC.

Cigarettes now on the market vary considerably, particularly in respect to the tar and nicotine content of the main stream smoke. By means of a filter or by varying the blend of tobacco or by pre-treating the tobacco or by various other means, it is possible to reduce the tar and nicotine content of the smoke to almost any specified degree. There is nothing very new about this. Indeed, I think it likely that at any time during the last several years almost every major cigarette company was in the position where they could have produced cigarettes with extremely little tar and nicotine. Although reduction in tar is usually accompanied by a reduction in taste, taste can be increased or altered by putting in certain additives or by mixing in a little tobacco of a strong tasting variety.

There is evidence that people who smoke cigarettes which are relatively low in tar and nicotine content tend to cough less than people who smoke cigarettes which are high in tar and nicotine content. However, at this time there is no direct evidence based upon studies of man that any type of cigarette now on the market or available to be put on the market differs from other types in respect to its effect upon death rates or the occurrence of serious diseases in man. The lack of such evidence on this matter is due to the fact that it is extremely difficult to obtain. Therefore, this lack of evidence should not be taken as an indication that various types of cigarettes do not in fact differ in the degree of their harmful effects. Indeed, it seems likely that of the various brands of cigarettes now on the market, some are less harmful than others.

If progress is to be made, we must proceed along lines suggested by indirect evidence and theoretical considerations. My further comments are made in this spirit.

Cigarette smoke is a mixture of particles and various gases. When condensed, the particles form what is usually referred to as "tar." Thus, a reduction of tar in cigarette smoke means a reduction in the quantity of material contained in the particles. The tar is a mixture of a great many different chemical substances, one of which is nicotine. Hereafter, for clarity, I will use the term "total tar" to mean all of the tar including nicotine and will use the term "tar" to refer to all of the tar except nicotine.

Death rates are higher increase with the number which the smoke is inhaled; the amount of smoke drawn; the cause of this. It is reasonable to assume that a cigarette contains a certain amount of smoke material (i.e. tar, nicotine) and that the lungs with the smoking of cigarettes have harmful effects.

Major attention has been given to cigarette smoke rather than to the smoke. If it were known that the smoke is harmful, it would be assumed that a cigarette is a harmful cigarette. There is a move in the right direction on the relative role played by the smoke.

Now let us consider how a reduction in the harmful ingredients of cigarette smoke can be achieved.

There are many agents in cigarette smoke, but almost all are harmful. With some agents, the amount of harm is a function of the amount, for example, if a specified amount of a certain agent is administered during the course of eight or ten years, the effect of administering it is true of agents, such as tar.

Whether the type of dose is the most harmful ingredient in cigarette smoke is of importance in respect to the problem. If it does apply, then it would be from the smoke; it would be at a level below that at which it is administered in small doses during the course of eight or ten years. Particular importance is given to the tar and nicotine content of cigarette smoke. One can be satisfied with cigarettes which contain less than about 0.4 mg. of nicotine.

The problem is greatly complicated by the multiplicity of harmful ingredients in cigarette smoke and the incidence rates and death rates of cancer and cancer of several organs. The components of cigarette smoke are all of the harmful effects. On the other hand, many components are involved; and their research on this matter is still in progress.

I will mention some of the complexity of the problem.

The only unique thing about cigarette smoke is probably the only unique thing about the burning of other vegetable matter. Milligram for milligram, the fastest acting of all known poisons produce rapid death if administered in large doses and administered during the course of eight or ten years. Under these conditions, the heart, the peripheral arteries, the functioning of the heart (the quickening of the heart beat) are probably pleasurable or at least not harmful. It is hard to escape the conclusion that a large proportion of the harm done by cigarette smoke is in the form of smoking (cigarette smoking, snuffing, or combined with drinking, or combined with other factors). I doubt that many cigarettes containing no nicotine are less harmful than cigarettes containing nicotine.